*भारतीय मानक*
*Indian Standard*

**IS 9079 : 2018**
**(Reaffirmed 2022)**

# कृषि और पानी की आपूर्ति के उद्देश्य के लिए साफ, शीतल जल के लिए मोनोसेट पंप — विशिष्टि

*( तीसरा पुनरीक्षण )*

# Monoset Pumps for Clear, Cold Water for Agricultural and Water Supply Purposes — Specification

*( Third Revision )*

ICS 23.100.10

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**September 2018** **Price Group 7**

Pump Sectional Committee, MED 20

## FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Pumps Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1979 and revised in 1989 and 2002. The major changes in the second revision were:

a) Amendments 1, 2 and 3 have been reviewed and incorporated in the standard;
b) Scope of monoset pumps extended from pumps for clear, cold water for agricultural purposes to pumps for clear cold water for agricultural and water supply purposes; and
c) Electrical testing for monoset pumps modified.

Since then three amendments were issued.

In this revision, all the amendments have been reviewed and incorporated. Following important changes are made in this revision:

a) Latest materials of construction (MOC), covering all types of manufacturing process have been incorporated for impeller; and
b) General requirements have been modified to include requirements for balancing, prime movers and earthing.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’.The number of significant places retained in the rounded off value should be the same as that of the specified value in this standards.

## *Indian Standard*

# MONOSET PUMPS FOR CLEAR, COLD WATER FOR AGRICULTURAL AND WATER SUPPLY PURPOSES — SPECIFICATION

*( Third Revision )*

## 1 SCOPE

This Indian Standard specifies the requirements for monoset pumps (single/multi stage) using single/three phase a.c. induction motor/motor portion for handling clear, cold water for agricultural and water supply purposes.

## 2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All Standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

## 3 UNITS

**3.1** Units relating to pumps as specified in **2** of IS 5120 shall be applicable.

## 4 TERMINOLOGY

Terminology relating to pumps as specified in **3** of IS 5120, shall be applicable, in addition to the following:

### 4.1 Monometric Suction Lift

Manometric suction lift is the vacuum gauge/suction manometer reading in meter of water column when pump operates at suction lift.

### 4.2 Clear, Cold Water

Characteristics of clear, cold water are specified below:

a) Turbidity: 50 ppm (silica scale), *Max*;
b) Chlorides: 500 ppm, *Max*;
c) Total solids: 3 000 ppm, *Max*;
d) pH value : 6.5 to 8.5;
e) Temperature: 33°C, *Max*;
f) Specific gravity: 1.004, *Max*; and
g) Hardness (as CaCO3), (drinking water): 300 mg, *Max*

NOTE — If any characteristic of water differs from these specifications, the pump constructional details shall be agreed between the manufacturer/supplier and the user, and shall be specified in the order.

## 5 CLASSIFICATION

Classification relating to pumps shall be as specified in **6** of IS 5120, and for motors as specified in IS 1885 (Part 35), IS 7538 and IS 14582 as may be applicable.

## 6 NOMENCLATURE

Nomenclature of the parts commonly used in monoset pumps shall be as given in Fig. 1 and 2 read with Table 2.

## 7 CONSTRUCTIONAL FEATURES

### 7.1 Material of Construction

It is recognized that a number of materials of construction are available to meet the needs for pumps, handling clear, cold water. A few typical materials are indicated below merely for guidance to the manufacturer and the user:

| *Sl. No.* | *Component* | *Material of Construction* |
|---|---|---|
| 1. | Casing | Casting grade FG 200 of IS 210 |
| 2. | Impeller | Casting grade FG 200 of IS 210 or bronze grade LTB 2 of IS 318 or IS 1865 Iron castings with spheroidal or nodular graphite grade 400/12 |
| 3. | Casing ring and impeller ring (if provided) | Casting grade FG 200 of IS 210 or bronze grade LTB 2 of IS 318 |
| 4. | Shaft | Class 3A of IS 1875 |
| 5. | Shaft sleeve (if provided) | Bronze grade LTB 2 of IS 318 or stainless steel grades X 04 Cr 12, X 12 Cr 12 or X 20 Cr 13 of IS 6603 or IS 6911 |
| 6. | Bush | Bronze grade LTB 2, 3 or 4 of IS 318 or Nitrile/cutless rubber |

NOTES

**1** The material listed is to be considered as only typical and indicative of minimum requirement of the material properties. The use of materials having better properties is not prejudiced by the details provided above.

**2** To get benefit from advancement in technology of plastics, thermoplastic materials, such as polyphenylene oxide (PPO), polycarbonate, acetyl, nylon 66, polytetrafluoroethylene (PTFE), etc, may be used for pump parts like shaft sleeves, casing, impeller, wearing rings, glands, etc.

**3.** It is recommended to use molybdenum disulphide ($MOS_2$) lubricated gland packing if stainless steel shaft sleeve is used.

### 7.2 Gaskets, Seals and Packings

Gaskets, seals and packings used for clear, cold water pumps shall conform to the applicable requirements specified in **5.2** of IS 5120.

## 8 FACTORS AFFECTING PUMP PERFORMANCE

Factors affecting the pump performance shall be as specified and applicable as per **10** of IS 5120.

## 9 DESIGN FEATURES

**9.1** The pump shall have suitable features, properly designed to ensure satisfactory performance. In particular, the design features such as the following shall be incorporated.

**9.1.1** The pump may be equipped with replaceable bearing and wearing ring, wherever provided.

**9.1.2** The pump shall be capable to perform as per guaranteed duty point at the manometric suction lift as specified in Table 1.

**9.1.3** The motor shall be of continuous duty as specified in IS/IEC 60034-1.

**Table 1 Manometric Suction Lift for Various Discharge Rates and Speed Segments at Mean Sea Level and at 33ºC Water Temperature**

( *Clause* 9.1.2 and 13.6 )

| Manometric Suction Lift | Discharge Rate Range (l/s) | |
|---|---|---|
| (m) | 4-Pole | 2-Pole |
| 6.0 | Up to 72 | Up to 24 |
| 5.5 | 72-93 | 24-29 |
| 5.0 | — | 29-33.5 |
| 4.5 | — | 33.5-38.5 |
| 4.0 | — | 38.5-43.5 |
| 3.5 | — | 43.5-50 |

NOTE — While the manometric suction lift indicated is to be maintained at guaranteed duty discharge rate, it may not be always practically possible. Hence, the requirement of **13.6.1** and **13.6.2** shall be deemed to have met if the manometric suction lift is maintained at discharge rate within –5 percent to +10 percent of guaranteed discharge rate.

### 9.2 Voltage and Frequency Variation

Monoset pumps and motor shall be capable to operate and deliver rated output in the following range of voltage and supply frequency:

a) The terminal voltage differing from this rated value by not more + 6 percent and – 15 percent;

b) The frequency differing from its rated value by not more than ± 3 percent; and

c) Any combination of above.

**9.3** The manufacturer shall have a system of controlling dimensional accuracy within a scheme of fits and tolerance limits. The system shall help interchangeability and fitment at site for replacement spares during subsequent repair and maintenance.

### 9.4 Efficiency

The pump efficiency of monoset pumps at duty point as declared by the manufacturer for 2 and 4 poles shall not be less than given in Fig. 3 to Fig. 6 and beyond this range, the efficiency shall be declared by the manufacturer.

## 10 GENERAL REQUIREMENTS

The general requirements for the pump shall be as specified and applicable as per **17** of IS 5120.

### 10.1 Casing

Pump casing shall be of robust construction and shall be tested to withstand Hydrostatic pressure test specified in **12.6**.

### 10.2 Impeller

The impeller may be of enclosed or semi-open type.

### 10.3 Shaft

The shaft shall be of adequate size to transmit the required power.

### 10.4 Balancing

**10.4.1** In case of 2-pole monoset, the impeller and rotor shall be dynamically balanced to grade 6.3 of IS/ISO 1940-1.

**10.4.2** In case of 4-pole monoset, the impeller shall be statically or dynamically balanced and rotor shall be dynamically balanced to grade 6.3 of IS/ISO 1940-1.

**10.4.3** The plastic and sheet metal impeller need not be balanced.

**10.4.4** Balancing here means the balancing of the unbalanced rotating mass in the impeller and not balancing of the axial hydraulic thrust in the impeller.

### 10.5 Provision for Earthing

Earthing of the motor shall be done in accordance with the relevant provisions of IS 3043.

### 10.6 Terminal Marking and Direction of Rotation

**10.6.1** Terminal markings shall be in accordance with IS/IEC 60034-8.

**10.6.2** The direction of rotation of pump set is designated clockwise or anti-clockwise as observed when looking at the pump shaft from the driving end.

**10.6.3** The direction of rotation shall be clearly and securely marked by incorporating an arrow on the pump set.

### 10.7 Prime Mover

**10.8.1** *Single Phase Motors*

**10.8.1.1** *Rated voltage and rated frequency*

Preferred rated voltage and frequency shall be 240 V and 50 Hz respectively.

Motor designed for operation at voltages other than 240 V shall be considered as complying with this standard provided they comply in all respects except full load current (maximum), which shall be changed in inverse proportion of the voltage.

**10.8.1.2** *Ratings*

Preferred output ratings of the motors for monoset pumpsets shall be 0.37, 0.55, 0.75, 1.1, 1.5 and 2.2 kW.

NOTE — Rating above 2.2 kW may be as declared by the manufacturer.

**10.8.1.3** *Types of motors*

a) Capacitor Start Induction Run motor (CSIR);
b) Capacitor Start and Run motor (CSR); and
c) Capacitor Start and Capacitor Run motor (CSCR)

**10.8.2** *Three Phase Motors*

**10.8.2.1** *Rated voltage and rated frequency*

Preferred rated voltage and frequency shall be 415 V and 50 Hz respectively.

Motor designed for operation at voltages other than 415 V shall be considered as complying with this standard provided, they comply in all respects except full load current (maximum), which shall be changed in inverse proportion of the voltage.

**10.8.2.2** *Ratings*

Preferred output ratings of the motors for moonset pumpsets shall be 0.37, 0.55, 0.75, 1.1, 1.5, 2.2, 3.7, 5.5, 7.5, 9.3, 11, 15, 18.5 and 22 kW.

NOTE — Rating above 22 kW may be as declared by the manufacturer.

**10.8.2.3** *Type of motors*

Three phase Squirrel cage induction motors

**10.8.3** *Rated Speeds*

Preferred rated speed shall be those corresponding to 2 pole and 4 pole.

## 11 TEST FOR ELECTRICAL PERFORMANCE ON MOTOR FOR MONOSET

### 11.1 GENERAL

**11.1.1** Routine and type test on monoset shall be performed as specified in **11.7** and **11.8**. The general requirements of the motor with regard to site conditions, voltage and frequency, type of enclosures, methods of cooling, materials, duty-rating, terminal marking and earthing shall be in accordance with IS 7538, for three phase motor or IS 14582, for single phase motor.

**11.1.2** While conducting routine and type tests on monoset pump for electrical performance, supply voltage shall be the rated voltage and frequency shall be within ± 3 percent of rated frequency.

**11.1.3** In case of three-phase motor for monosets, the value of the current (amperes) shall be the average value of currents (amperes) measured in all the three phases.

**11.1.4** For conducting routine and type test of electric motors as per IS 7538 and IS 14582, the test methods shall be followed as per IS 4029, and IS 7572 respectively.

**11.1.5** However, for three phase motors above 22 kW rating, the declared value of efficiency shall not be lesser than 22 kW value.

**11.1.6** Performance values of single phase motors of other ratings exceeding 2.2 kW shall be declared by the manufacturer.

**11.1.7** However, for single phase motors above 2.2 kW rating, the declared value of efficiency shall not be lesser than 2.2 kW value.

**11.1.8** However, in case of pumpset, motor need not be tested for full load test

### 11.2 Insulation Resistance Test

Insulation resistance tests shall be as per IS 7538 or IS 14582 as may be applicable.

### 11.3 High Voltage Test

High voltage test shall be as per IS 7538, or IS 14582, as may be applicable.

### 11.4 Temperature Rise Test

**11.4.1** Temperature rise test for winding shall be carried out on sample pumpset:

a) at rated voltage and supply frequency within ± 3 percent of rated frequency, and
b) at 85 percent of rated voltage and supply frequency within ± 3 percent of rated frequency.

**11.4.1.1** *Temperature rise test at rated voltage*

Set the load for the observed maximum current in the specified operating head range of the electric monoset at the rated voltage and supply frequency and run the pumpset to reach thermal equilibrium condition. Stop the pumpset and measure the winding resistance and room temperature within 30 s.

The temperature-rise shall not exceed the specified temperature limits in Table 7 of IS/IEC 60034-1.

**11.4.1.2** *Temperature rise test at reduced voltage*

Before starting the test, ensure sample motor winding temperature nearest value to the ambient temperature. Run the set at maximum current in operating head range at rated voltage. Reduce the voltage to 85 percent of rated voltage in this condition. Run the pumpset at this voltage and supply frequency, to reach thermal equilibrium condition. Stop the pumpset and measure the winding resistance and room temperature within 30 s.

The temperature-rise shall not exceed the specified temperature limits in Table 7 of IS/IEC 60034-1 by more than 10°C when the motor is continuously operating at 85 percent of rated voltage.

**11.4.2** For conducting temperature rise test, the pump itself shall be used for loading the motor.

**11.4.3** Determination of temperature rise of winding by resistance method

The temperature rise ($t_2$ to $t_1$) may be obtained from the ratio of the resistance by the formula:

$$[(t_2 + 235)/(t_1 + 235)] = R_2/R_1$$

where,

$t_2$ = temperature (°C) of the winding, at the end of the test;

$t_1$ = temperature (°C) of the winding (cold), at the moment of the initial resistance measurement; and

$R_2$ = resistance of the winding, at the end of the test;

$R_1$ = initial resistance of the winding (cold).

For practical purposes, the following alternative formula may be found convenient:

$$(t_2 - t_a) = [(R_2 - R_1)/R_1]*(235 + t_1) + (t_1 - t_a)$$

where,

$t_2$ = temperature (°C) of the winding, at the end of the test;

$t_a$ = temperature (°C) of cooling air or gas, at the end of the test;

$R_2$ = resistance of the winding, at the end of the test;

$R_1$ = initial resistance of the winding (cold); and

$t_1$ = temperature (°C) of the winding (cold), at the moment of the initial resistance measurement.

## 11.5 Locked Rotor Test

**11.5.1** For three phase induction motors the test shall be carried out in accordance with provisions of IS 4029. The test may be carried out at reduced voltage. The readings of the input current, power and breakaway rotor torque shall be determined. The values of breakaway torque shall be not less than the value given in Table 5.

**11.5.2** For Single phase induction motors the test shall be carried out in accordance with provisions of IS 7572. The test may be carried out at reduced voltage. The readings of the input current, power and breakaway rotor torque shall be determined. The values of breakaway torque shall be not less than the value given in Table 6 to Table 8

## 11.6 Speed

Preferred rated speed shall be those corresponding to 2 poles and 4 poles. The rated speed (minimum) shall be as given in the Table 2 for three phase motors and in Table 6 to Table 8 for single phase motors for applicable motor rating.

## 11.7 Routine Test

Following shall constitute the routine test for electrical performance on motor:

a) High voltage test;

b) Insulation resistance test;

c) Test for no load current and power input at rated voltage and supply frequency;

d) Locked rotor test for locked rotor current, power input at a suitable voltage and supply frequency; and

e) Reduced voltage running up test shall be conducted at a voltage not exceeding 75 percent of voltage in case of single phase monoset and 60 percent of the rated voltage in case of three-phase monoset to check the ability of the motor to attain full speed.

NOTE — In case of three-phase motor for monosets, the value of the current (amperes) shall be the average value of currents (amperes) measured in all the three phases.

The requirements and values shall be in accordance with those specified in IS 7538 or IS 14582 as may be applicable.

## 11.8 Type Test

**11.8.1** Following shall constitute the type test for electrical performance on motor:

a) Measurement of stator winding; resistance

b) High voltage test;

c) Insulation resistance test;

d) Test for no load current and power input at rated voltage and supply frequency;

e) Locked rotor test for locked rotor current, power input at a suitable voltage and supply frequency;

f) Breakaway (Starting) torque;

g) Reduced voltage running up test shall be conducted at a voltage not exceeding 75 percent of voltage in case of single phase monoset and 60 percent of the rated voltage in case of three-phase monoset to check the ability of the motor to attain full speed;

h) Temperature rise test at rated voltage; and

j) Temperature rise test at reduced voltage.

NOTE — Temperature rise test however shall be done as per *Clause* **11.4**.

The requirements and values for test specified at a), b), c), d), e), f) and g) shall be in accordance with those specified in IS 7538 or IS 14582, as may be applicable. For h) and j) please refer **11.4**.

**11.8.2** The sampling and criteria of conformity for type test shall be as per Table 4.

## 12 TEST FOR HYDRAULIC PERFORMANCE ON PUMP FOR MONOSET

### 12.1 Sampling

The sampling and criteria of conformity for hydraulic performance shall be as per Table 3

### 12.2 Laboratory Tests

The testing of performance of the monoset pumps shall be in accordance with IS 11346.Testing procedures as given in IS 11346, shall be followed.

### 12.3 Head Measurement

Measurement of head shall conform to IS 11346.

### 12.4 Flow Measurement

Measurement of flow shall conform to IS 11346.

**12.5** For current and power measurement, Ammeter and Watt meter of adequate capacity shall be used.

### 12.6 Hydrostatic Pressure Test

Pump casing shall be of robust construction and shall be tested to withstand 1.5 times the maximum discharge pressure for 1 min.

## 13 GUARANTEE AND TOLERANCE ON PUMPSET PERFORMANCE

### 13.1 Guarantee of Performance

**13.1.1** The pumpset shall be guaranteed for their performance of the nominal volume rate of flow and the nominal head at the guaranteed duty point. The overall efficiency of the pumpset shall be guaranteed at the declared duty point only.

**13.1.2** The guarantee shall be deemed to have been met with, if the measured values of head, volume rate of flow and overall efficiency are within the limits indicated in *clause* **8** of IS 11346. However, after applying the tolerance, overall efficiency value shall not be less than that derived from Fig. 3 to 6.

**13.1.3** Monoset motor shall not get overloaded in the specified operating head range at rated voltage and supply frequency.

The pump shall be tested for the operating head range. However, it shall not be less than + 10 percent (min) and –20 percent (min) of the guaranteed duty head up to 20 m. Above 20 m, the limits shall be from + 5 percent (min) to – 20 percent (min) of the guaranteed duty head

**13.1.4** The tolerance shall apply to guaranteed duty point only.

### 13.2 Head and Discharge

**13.2.1** Pump performance shall be declared at the rated voltage and rated frequency. Following affinity laws shall be applied for correction of performance at rated frequency.

Discharge (Q) $\alpha$ f

Head (H) $\alpha$ $f^2$

Power (P) $\alpha$ $f^3$

(where, f = supply frequency)

**13.2.2** The pumpset shall be guaranteed at the nominal duty point. The same pumpset may also deemed to have met the guarantee if the new duty point lies within the specified tolerance of head (± 4 percent) and discharge (± 7 percent) of nominal duty point and meets all other pump performance characteristics specified.

### 13.3 Current

**13.3.1** The rated current of motor (maximum) as given in the table-5 for three phase motors and in Table 6 to Table 8 for single phase motors for applicable motor rating.

**13.3.2** The rated current of motor (maximum) is given in the corresponding table for applicable motor rating are for preferred rated voltage only. For other voltages, it shall be in inverse proportion to the preferred rated voltage.

**13.3.3** Manufacturer shall declare the rated current of motor less than or equal to the rated current (maximum) of motor as given in the corresponding table for applicable motor rating.

**13.3.4** For arriving the permissible limit of maximum current in the operating head range for checking the non-overloading requirement in the operating head range of the pumpset, select the rated current of motor (maximum) as given in corresponding table for applicable motor rating, multiply the rated current of motor by 1.07.

**13.3.5** For other voltages, the permissible limit of maximum current in the operating head range shall be in inverse proportion to the preferred rated voltage.

**13.3.6** In the case of lesser value declaration on the rated current of motor (maximum) by the manufacturer, 7 percent plus tolerance shall be allowed for arrive the permissible limit of maximum current in the operating head range for checking the non-overloading requirement in the operating range.

### 13.4 Overall Efficiency

**13.4.1** The minimum pump efficiency shall be as given in the Fig. 3 to 6. When the declared duty point lies between the efficiency lines higher value shall be taken.

**13.4.2** For minimum overall efficiency of the pumpset, multiply minimum pump efficiency by corresponding motor efficiency factor as per Table 5 for three phase motors and as per Table 6 to 8 for single phase motors.

**13.4.3** A superior value of overall efficiency value may be declared by the manufacturer and the relevant tolerances shall be applied. After applying tolerance it should not be lower than the minimum overall efficiency value.

**13.4.4** Pump efficiency of the pumpsets having declared duty point beyond the pump efficiency lines on either side may be declared by the manufacturer and applicable tolerance applied.

### 13.5 Prime Mover Rating

The pumpset shall be tested at rated conditions and the maximum current consumption of the pumpset at the operating head range shall be verified. The actual verified current shall not be less than 75 percent of the maximum declared current at the rated voltage.

> Note — The above clause is to ensure proper rating of pump set.

### 13.6 Limitations,Correction for Altitude and Temperature

While carrying out verification test for manometric suction lift, correction shall be applied to manometric suction lift figures as specified in Table 1 for altitude at the test and water temperature other than 33ºC. These corrections shall be in accordance with **13.6.1** and **13.6.2**.

**13.6.1** *Correction for Altitude*

Barometric pressure at the test place shall be recorded. The difference between the atmospheric pressure at mean sea level, that is, 10.33 mWC and the barometric pressure recorded at the test place shall be deducted from the manometric suction lift figures given in Table 1.

**13.6.2** *Correction for Temperature*

Manometric suction lift specified in Table 1 modified as specified in **13.6.1** shall be increased further or reduced as given in Table 9 whenever water temperature is below or above 33ºC.

**13.6.3** *Suction Limitations*

Suction limitations affecting the performance of pumps for clear, cold water shall be the same as those specified in *Clause* **9** of IS 5120.

## 14 PERMISSIBLE INACCURACIES IN MEASUREMENTS

**14.1** In all commercial acceptance tests for agricultural pumps, a certain tolerance shall be allowed to the manufacturer on his guarantee to cover the inaccuracies of the equations for volume rate of flow, errors of observation and unavoidable errors of the instruments employed.

**14.2** The permissible inaccuracy in the measurement of various quantities and all pertinent apparatus used shall be as indicated in IS 11346. However, measuring equipment with higher accuracy class may also be used.

## 15 MARKING AND PARAMETERS TO BE DECLARED BY THE MANUFACTURER

**15.1** The monoset pumps shall be marked with the following parameters, which shall be declared by the manufacturer:

a) Motor rating (kW);
b) Pipe size (size of suction and delivery pipe nominal diameter, in mm);
c) Type/Model;
d) Type of motor — INDUCTION MOTOR — (CSIR/CSCR/CSR)[1];
e) Rated voltage;
f) Rated frequency (Hz);
g) Number of phases;
h) Class of insulation of motor;
j) Winding connection (STAR/DELTA/STAR-DELTA)[2];
k) Type of duty;
m) Numbers of poles;
n) Total head, Volume rate of flow at the guaranteed duty point;
p) Operating head range;
q) Overall efficiency at guaranteed duty point;
r) Maximum current (in operating head range);
s) Serial number of monoset pump; and
t) Manufacturer’s name or trade-mark.

NOTES

**1** For single phase motor only

**2** For three phase motor only

**15.1.1** The manufacturer's brand name or logo may be embossed or indented on the pump casing.

### 15.2 Installation

The pump shall be installed in accordance with the manufacturer's recommendation.

### 15.3 BIS Certification Marking

The monoset pumps may also be marked with BIS Standard Mark.

**15.3.1** The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations made there under. The details of the conditions under which the licence for use of the Standard Mark may be granted to manufacturers or producers, may be obtained from the Bureau of Indian Standards.

**Table 2 Typical Materials for Components of Monoset Pumps**

( *Clause* 6 and Fig. 1 and Fig. 2 )

| Part No. | Name of Part | Brief Description |
|---|---|---|
| 1 | Delivery casing | A portion of the pump which houses the impeller and includes the volute |
| 2 | Delivery casing — First stage | A portion of the pump which houses the first stage impeller and includes the volute |
| 3 | Delivery casing — Second stage | A portion of the pump that houses the second stage impeller and includes the volute |
| 4 | Impeller — First stage | A first stage rotating element producing head |
| 5 | Impeller — Second stage | A second stage rotating element producing head |
| 6 | Impeller | A rotating element producing head |
| 7 | Delivery flange | A part that secures delivery pipe to delivery bore |
| 8 | Suction flange | A part that secures suction pipe to suction bore |
| 9 | Mounting casing | A casting component in mono-blocs, accommodating pump on one side and motor on the other |
| 10 | Motor body | Houses wound stator sub-assembly and dissipate heat produced in wound stator through its fins |
| 11 | Cover N. D. E. | A protective cover for bearing and motor |
| 12 | Impeller key | A parallel-sided piece used to prevent the impeller from rotating relative to the shaft |
| 13 | Impeller nut | A threaded piece used to secure the impeller on the shaft usually provided complete with locking device |
| 14 | Mechanical seal (Rotating element) | A flexible device mounted on the shaft in stuffing box and having lapped sealing face held against the stationary sealing face |
|  | Mechanical seal (Stationary element) | A sub-assembly consisting of one or more parts mounted on the stuffing box and having a lapped sealing face |
| 15 | Shaft sleeve | A replaceable sleeve for protecting the shaft where it passes through the stuffing box and stage bushings |
| 16 | Shaft | A shaft which holds the rotating impeller and transmits the power |
| 17 | Spacer | A cylindrical piece used to maintain desired clearance |
| 18 | Gland | A follower which compresses packing in a stuffing box |
| 19 | Gland packing | A pliable lubricated material used to provide a seal around the portion of the shaft located in the stuffing box |
| 20 | Priming plug | A part to facilitate priming |
| 21 | Rotor | Converts electromagnetic energy into mechanical energy by utilizing magnetic path created by stator |
| 22 | Wound stator | Converts electrical energy (obtained from power supply) to magnetic energy |
| 23 | Water deflector | A device to protect bearings by slinging off stuffing box leakage |
| 24 | Wearing ring | A replaceable ring which maintains the desired radial clearance between impeller and casing |
| 25 | Washer | A part used to prevent loosening nut and also to distribute the force exerted on connected parts |
| 26 | Ball bearing D.E. | Rolling bearing |
| 27 | Ball bearing N.D.E. | Rolling bearing |
| 28 | Fan | Circulates air for cooling motor body |
| 29 | Fan cover | Prevents contact between rotating part (fan) and external objects like human organs and guides the air |

## Table 3 Sampling and Criteria of Conformity for Hydraulic Performance of Monoset Pumps

( *Clause* 12.1 )

| No. of Pumps in Lot | Sample Size | Acceptance No. |
|---|---|---|
| Up to 7 | 1 | 0 |
| 8 to 15 | 2 | 0 |
| 16 to 25 | 3 | 0 |
| 26 to 50 | 4 | 0 |
| 51 to 100 | 5 | 0 |
| 101 to 150 | 8 | 0 |
| 151 to 300 | 13 | 0 |
| 301 to 500 | 20 | 0 |
| 501 to 1000 | 32 | 1 |
| 1001 and above | 50 | 2 |

## Table 4 Sampling and Criteria of Conformity for Monoset Pumps for Type Test

( *Clause* 11.8.2 )

| No. of Pumps in Lot | Sample Size | Acceptance No. |
|---|---|---|
| Up to 25 | 1 | 0 |
| 26 to 50 | 2 | 0 |
| 51 to 100 | 3 | 0 |
| Above 100 | 4 | 0 |

## Table 5 Rated Current of Motor and Motor Efficiency Factor Values for Three Phase Induction Motors.

( *Clause* 11.5 and 13.4.2 )

| Rating of Monoset (kW) | Rated Current (Maximum) of Motor (in Amps) | | Motor Efficiency Factor | | Rated Speed (minimum) (in rpm) | | Breakaway Torque in Percentage (In Terms of Full load Torque) (minimum) | |
|---|---|---|---|---|---|---|---|---|
| | 2-Pole | 4-Pole | 2-Pole | 4-Pole | 2-Pole | 4-Pole | 2-Pole | 4-Pole |
| 0.37 | 1.3 | 1.5 | 56 | 57 | 2720 | 1330 | 170 | 170 |
| 0.55 | 1.7 | 1.8 | 60 | 62 | 2760 | 1340 | 170 | 170 |
| 0.75 | 2.1 | 2.3 | 66 | 68 | 2780 | 1360 | 170 | 170 |
| 1.1 | 2.9 | 3.0 | 73 | 76 | 2790 | 1370 | 170 | 170 |
| 1.5 | 3.9 | 4.0 | 74 | 77 | 2800 | 1380 | 170 | 170 |
| 2.2 | 5.2 | 5.3 | 75 | 77.5 | 2810 | 1390 | 170 | 170 |
| 3.7 | 8.3 | 8.4 | 79 | 80 | 2820 | 1410 | 160 | 160 |
| 5.5 | 11.4 | 11.9 | 80 | 82 | 2830 | 1420 | 160 | 160 |
| 7.5 | 15.6 | 16 | 81 | 83 | 2840 | 1430 | 160 | 160 |
| 9.3 | 19.5 | 19.2 | 81.5 | 85 | 2850 | 1430 | 160 | 160 |
| 11 | 22.4 | 22.9 | 82 | 85.5 | 2860 | 1440 | 160 | 160 |
| 15 | 30.2 | 31.2 | 83 | 86 | 2870 | 1440 | 160 | 160 |
| 18.5 | 38.0 | 39.0 | 84.4 | 86 | 2870 | 1440 | 160 | 160 |
| 22 | 45.6 | 46.8 | 85.5 | 86.5 | 2880 | 1440 | 160 | 160 |

NOTES

**1** Rated current, rated speed and breakaway torque value of motor specified are as IS 7538 for 415 V rated voltage.

**2** For checking the non-overloading requirements in the operating head, range 7 percent plus tolerance on the rated current value to be permitted

## Table 6 Rated Current of Motor and Motor Efficiency Factor Values for Single Phase Capacitor Start and Run Motors

( *Clause* 11.5, 11.6 and 13.3.1 )

| Rating of Monoset (kW) | Rated Current (Maximum) of Motor (in Amps) | | Motor Efficiency Factor | | Rated Speed (minimum) (in rpm) | | Breakaway Torque in Percentage (In Terms of Full Load Torque) (minimum) | |
|---|---|---|---|---|---|---|---|---|
| | **2-Pole** | **4-Pole** | **2-Pole** | **4-Pole** | **2-Pole** | **4-Pole** | **2-Pole** | **4-Pole** |
| 0.37 | 3.7 | 3.9 | 54 | 56 | 2650 | 1325 | 30 | 30 |
| 0.55 | 5.0 | 5.3 | 58 | 60 | 2700 | 1350 | 30 | 30 |
| 0.75 | 6.2 | 6.6 | 63 | 66 | 2725 | 1350 | 30 | 30 |
| 1.1 | 8.6 | 9.1 | 68 | 70 | 2750 | 1375 | 30 | 30 |
| 1.5 | 11.5 | 12.2 | 70 | 72 | 2750 | 1375 | 30 | 30 |
| 2.2 | 15.3 | 16.2 | 72 | 74 | 2770 | 1390 | 30 | 30 |

NOTES

**1** Rated current, rated speed and Breakaway torque value of Motor specified are as per IS 14582 for 240 V rated voltage.

**2** For checking the non-overloading requirements in the operating head range 7 percentage plus tolerance on the rated current value to be permitted

## Table 7 Rated Current of Motor and Motor Efficiency Factor Values for Single Phase Capacitor Start Capacitor Run

( *Clause* 11.5, 11.6 and 13.3 )

| Rating of Monoset (kW) | Rated Current (Maximum) of Motor (in Amps) | | Motor Efficiency Factor | | Rated Speed (minimum) (in rpm) | | Breakaway Torque in percentage (In Terms of Full Load Torque) (minimum) | |
|---|---|---|---|---|---|---|---|---|
| | **2-Pole** | **4-Pole** | **2-Pole** | **4-Pole** | **2-Pole** | **4-Pole** | **2-Pole** | **4-Pole** |
| 0.37 | 3.7 | 3.9 | 54 | 56 | 2650 | 1325 | 150 | 150 |
| 0.55 | 5.0 | 5.3 | 58 | 60 | 2700 | 1350 | 150 | 150 |
| 0.75 | 6.2 | 6.6 | 63 | 66 | 2725 | 1350 | 150 | 150 |
| 1.1 | 8.6 | 9.1 | 68 | 70 | 2750 | 1375 | 150 | 150 |
| 1.5 | 11.5 | 12.2 | 70 | 72 | 2750 | 1375 | 150 | 150 |
| 2.2 | 15.3 | 16.2 | 72 | 74 | 2770 | 1390 | 150 | 150 |

NOTES

**1** Rated current, rated speed and Breakaway torque value of Motor specified are as per IS 14582 for 240 V rated voltage.

**2** For checking the non-overloading requirements in the operating head range7 percentage plus tolerance on the rated current value to be permitted.

## Table 8 Rated Current of Motor and Motor Efficiency Factor Values for Single Phase Capacitor Start Induction Motors

( *Clause* 11.5, 11.6 and 13.3 )

| Rating of Monoset (kW) | Rated Current of Motor (maximum) (in Amps) | | Motor Efficiency Factor | | Rated Speed (minimum) (in rpm) | | Breakaway Torque in Percentage (In Terms of Full Load Torque) (minimum) | |
|---|---|---|---|---|---|---|---|---|
| | 2-Pole | 4-Pole | 2-Pole | 4-Pole | 2-Pole | 4-Pole | 2-Pole | 4-Pole |
| 0.37 | 5.1 | 5.4 | 54 | 56 | 2700 | 1350 | 150 | 150 |
| 0.55 | 7.3 | 7.6 | 58 | 60 | 2725 | 1350 | 150 | 150 |
| 0.75 | 9.0 | 9.5 | 63 | 66 | 2750 | 1375 | 150 | 150 |
| 1.1 | 12.5 | 12.9 | 68 | 70 | 2775 | 1375 | 150 | 150 |
| 1.5 | 16.3 | 16.8 | 70 | 72 | 2775 | 1375 | 150 | 150 |
| 2.2 | 20.7 | 21.2 | 72 | 74 | 2800 | 1390 | 150 | 150 |

NOTES

**1** Rated current, rated speed and Breakaway torque value of Motor specified are as per IS 14582 for 240 V rated voltage.

**2** For checking the non-overloading requirements in the operating head range 7 percentage plus tolerance on the rated current value to be permitted.

## Table 9 Correction in Manometric Suction Lift for Water Temperature Beyond 33ºC

( *Clause* 13.6.2 )

| Water Temperature ºC | Vapour Pressure mWC | Correction in Manometric Suction Lift Above and Below 33ºC Water Temperature |
|---|---|---|
| 10 | 0.13 | + 0.39 |
| 15 | 0.18 | + 0.34 |
| 20 | 0.24 | + 0.28 |
| 25 | 0.33 | + 0.19 |
| 30 | 0.43 | + 0.09 |
| 33 | 0.52 | + 0.00 |
| 35 | 0.58 | - 0.06 |
| 40 | 0.76 | - 0.24 |
| 45 | 1.00 | - 0.48 |
| 50 | 1.28 | - 0.76 |

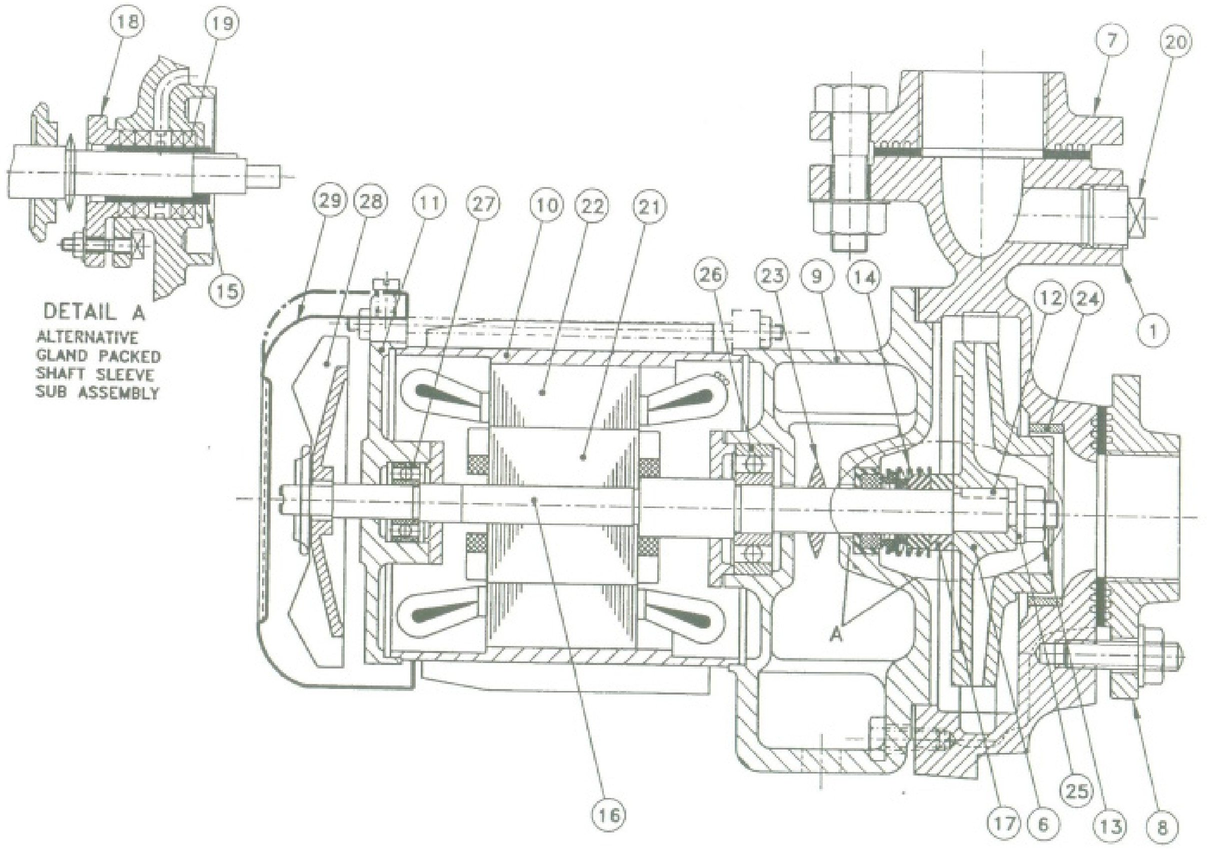


FIG. 1 TYPICAL ILLUSTRATION OF SINGLE STAGE MONOBLOC PUMP

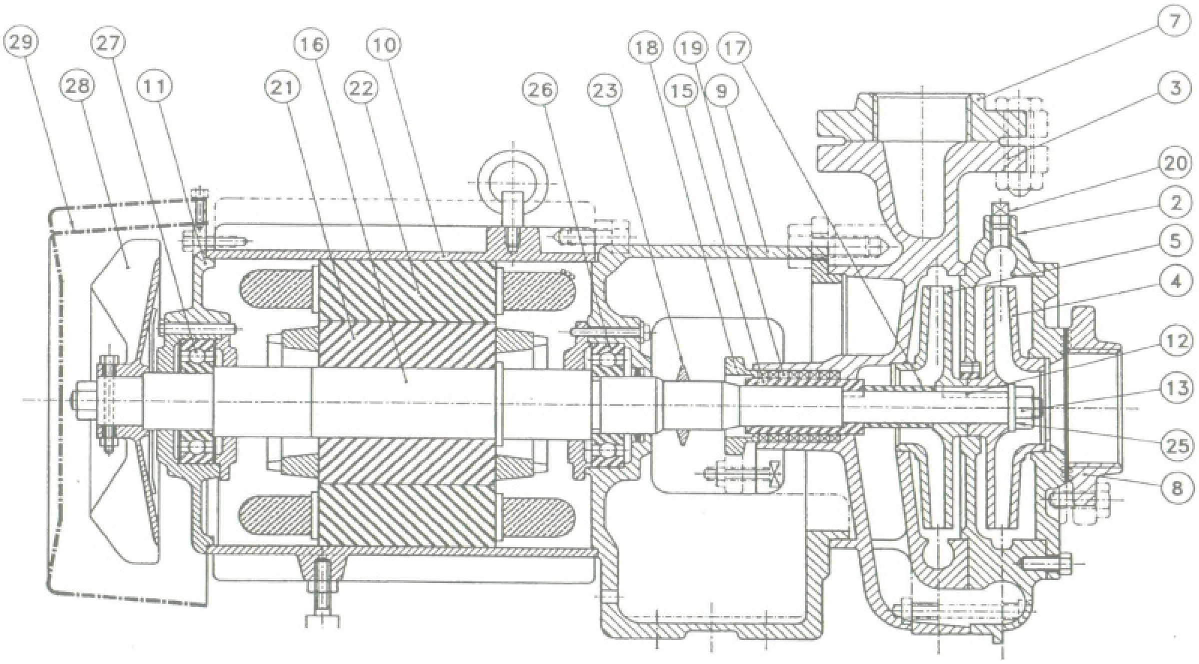
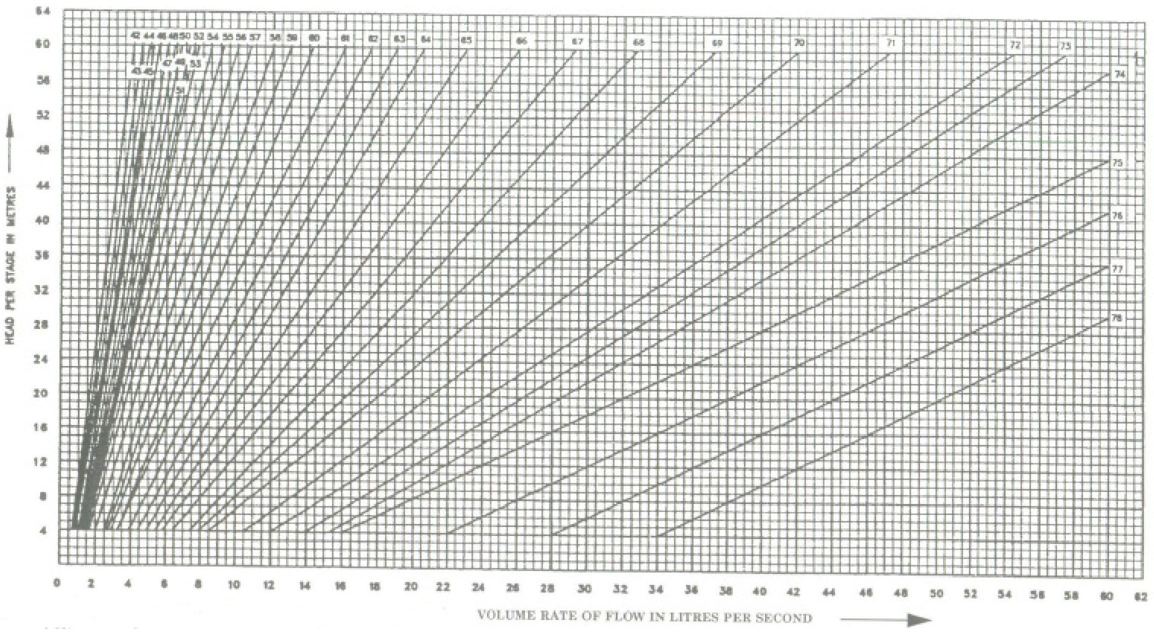


FIG. 2 TYPICAL ILLUSTRATION OF DOUBLE STAGE MONOBLOC PUMP

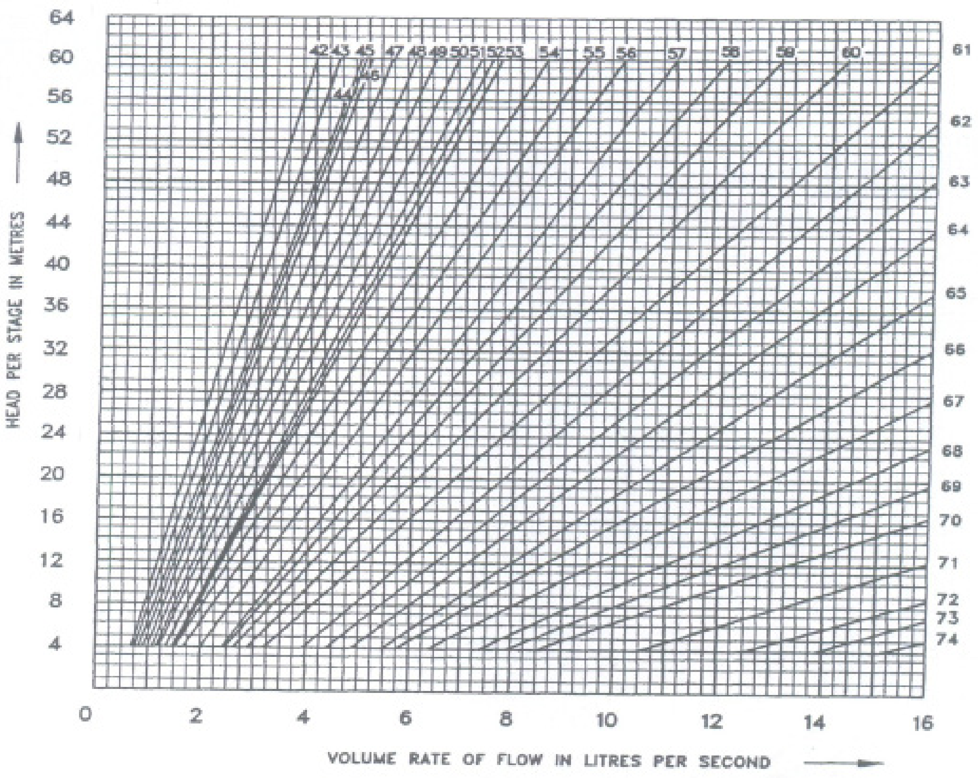


NOTES

**1** For volume rate of flow upto and including 16 litres per second, Fig 4 shall be referred.

**2** Where the points lies in between the efficiency lines higher value to be taken as minimum pump efficiency.

Fig. 3 Pump Efficiency (Minimum) in Percent for Monoset Pump
(2-Pole 50 Hz, for Volume Rate of Flow above 16 Litres per Second)

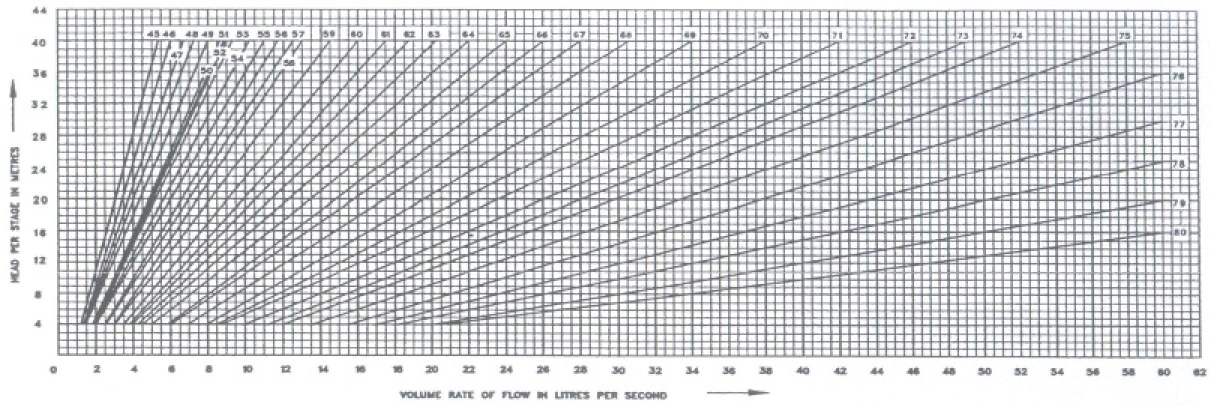


NOTES

**1** For volume rate of flow above16 litres per second, Fig 3 shall be referred.

**2** Where the points lies in between the efficiency lines higher value to be taken as minimum pump efficiency.

Fig.4 Pump Efficiency (Minimum) in Percent for Monoset Pump
(2-Pole 50 Hz , for Volume Rate of Flow upto and Including 16 Litres per Second)

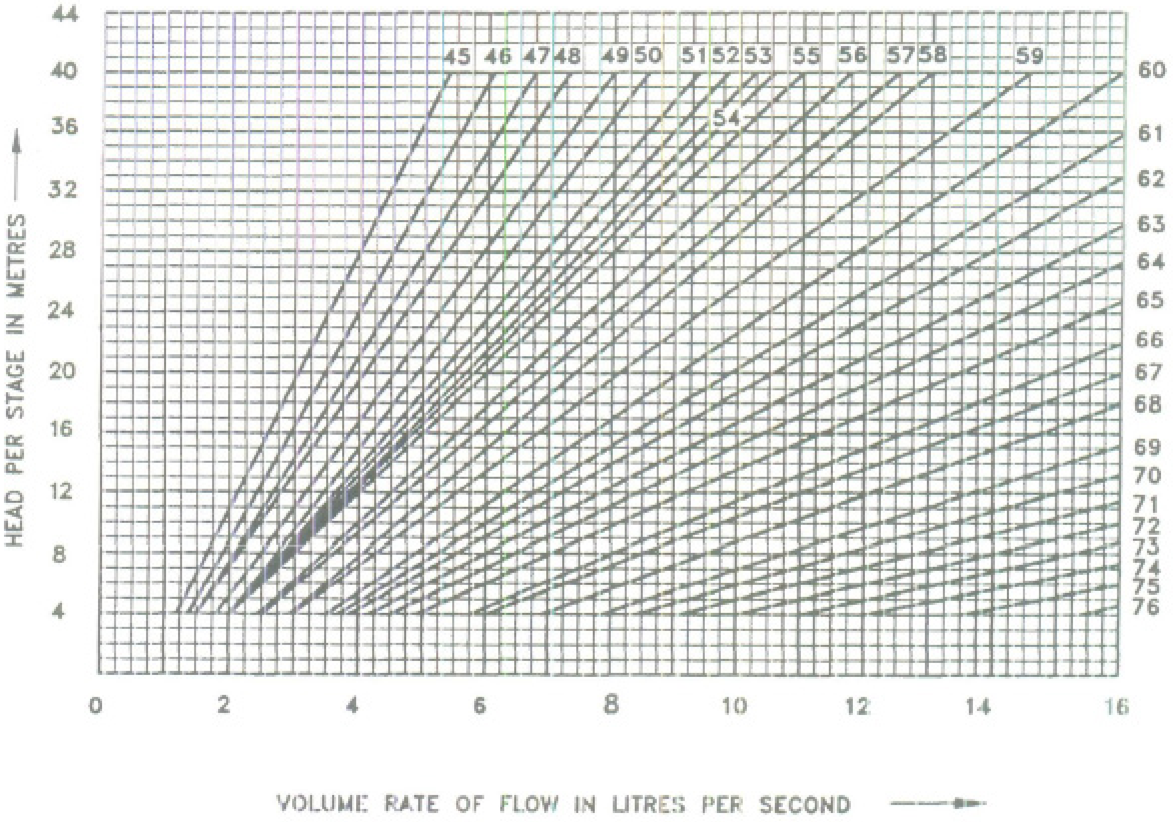


NOTES

**1** For volume rate of flow upto and including16 litres per second, Fig 6 shall be referred.

**2** Where the points lies in between the efficiency lines higher value to be taken as minimum efficiency

Fig. 5 Pump Efficiency (Minimum) in Percent for Monoset Pump
(4-Pole 50 Hz, for Volume Rate of Flow above 16 Litres per Second)



NOTES

**1** For volume rate of flow above 16 litres per second, Fig 5 shall be referred.

**2** Where the points lies in between the efficiency lines higher value to be taken as minimum efficiency

Fig. 6 Pump Efficiency (Minimum) in Percent for Monoset Pump
(4-Pole 50 Hz, for Volume Rate of Flow upto and Including 16 Litres per Second)

# ANNEX A

( *Clause* 2 )

## LIST OF REFERRED INDIAN STANDARDS

| *IS. No.* | *Title* |
|---|---|
| IS 210 : 2009 | Grey iron castings — Specification ( *fourth revision*) |
| IS 318 : 1981 | Specification for leaded tin bronze ingots and castings (*second revision*) |
| IS 1875 : 1992 | Carbon steel billets, blooms, slabs and bars for forgings — Specification ( *fifth revision*) |
| IS 1885 (Part 35) : 1993 | Electro technical vocabulary: Part 35 Rotating machines ( *first revision*) |
| IS 4029 : 2010 | Guide for testing three phase induction motors. |
| IS 5120 : 1977 | Technical requirements for rotodynamic special purpose pumps ( *first revision*) |
| IS 6603 : 2001 | Stainless steel bars and flats — Specification ( *first revision*) |
| IS 6911 : 2017 | Stainless steel plate, sheet and strip — Specification ( *first revision*) |
| IS 7538 : 1996 | Specification for three-phase squirrel cage induction motors for centrifugal pumps for agricultural applications ( *first revision*) |
| IS 7572 : 1974 | Guide for testing single phase AC and universal motors. |
| IS 11346 : 2002 | Code of acceptance tests for agricultural and water supply pumps ( *first revision*) |
| IS 14582 : 1998 | Single-phase small AC electric motors for centrifugal pumps for agricultural applications. |
| IS/ISO 1940-1 : 2003 | Mechanical vibration — Balance quality requirements for rotors in a constant (Rigid) state: Part 1 Specifications and verification of balance tolerances |
| IS 3043 : 1987 | Code of practice for earthing |
| IS/IEC 60034-1 : 2004 | Rotating electrical machines: Part 1 Rating and performance |
| IS/IEC 60034-8 : 2002 | Rotating electrical machines: Part 8 Terminal markings and direction of rotation |

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This Indian Standard has been developed from Doc No.: MED 20 (01449).

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